

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)



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Applicant's or agent's file reference 4FPO-12-13	<b>FOR FURTHER ACTION</b>	
International application No. <b>PCT/KR2005/000282</b>	International filing date( <i>day/month/year</i> ) <b>31 JANUARY 2005 (31.01.2005)</b>	Priority date ( <i>day/month/year</i> ) 02 FEBRUARY 2004 (02.02.2004)
International Patent Classification (IPC) or national classification and IPC  <b>C12N 15/29(2006.01)i, A01H 4/00(2006.01)i, A01H 1/06(2006.01)i</b>		
Applicant  <b>DONGBU HANNONG CHEMICAL CO., LTD. et al</b>		

- This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 6 sheets, including this cover sheet.
- This report is also accompanied by ANNEXES, comprising:
  - ☒ (sent to the applicant and to the International Bureau) a total of 4 sheets, as follows:
    - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
    - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
  - ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) \_\_\_\_\_, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box relating to Sequence Listing (see Section 802 of the Administrative Instructions).

- This report contains indications relating to the following items:
  - ☒ Box No. I Basis of the report
  - ☒ Box No. II Priority
  - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - ☐ Box No. IV Lack of unity of invention
  - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - ☐ Box No. VI Certain documents cited
  - ☐ Box No. VII Certain defects in the international application
  - ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand  <b>02 SEPTEMBER 2005 (02.09.2005)</b>	Date of completion of this report  23 MAY 2006 (23.05.2006)
Name and mailing address of the IPEA/KR  Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer  KIN, Ji Yun  Telephone No. 82-42-481-8288 

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.  
PCT/KR2005/000282

## Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
  - ☒ This report is based on translations from the original language into the following language English which is the language of a translation furnished for the purposes of:
    - ☐ international search (under Rules 12.3 and 23.1(b))
    - ☒ publication of the international application (under Rule 12.4)
    - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:
  - ☐ the international application as originally filed/furnished
  - ☒ the description:
    - pages 1-57, 62 as originally filed/furnished
    - pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
    - pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
  - ☒ the claims:
    - pages \_\_\_\_\_ as originally filed/furnished
    - pages\* \_\_\_\_\_ as amended (together with any statement) under Article 19
    - pages\* 58-61 received by this Authority on 13 March 2006
    - pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
  - ☒ the drawings:
    - pages 1/19-19/19 as originally filed/furnished
    - pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
    - pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
  - ☒ the sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.
3. ☐ The amendments have resulted in the cancellation of:
  - ☐ the description, pages \_\_\_\_\_
  - ☐ the claims, Nos. \_\_\_\_\_
  - ☐ the drawings, sheets \_\_\_\_\_
  - ☐ the sequence listing (*specify*): \_\_\_\_\_
  - ☐ any table(s) related to sequence listing (*specify*): \_\_\_\_\_
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
  - ☐ the description, pages \_\_\_\_\_
  - ☐ the claims, Nos. \_\_\_\_\_
  - ☐ the drawings, sheets \_\_\_\_\_
  - ☐ the sequence listing (*specify*): \_\_\_\_\_
  - ☐ any table(s) related to sequence listing (*specify*): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

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## Box No. II Priority

1. ☐ This opinion has been established as if no priority had been claimed due to the failure to furnish within the prescribed time limit the requested:
- ☐ copy of the earlier application whose priority has been claimed (Rule 66.7(a)).
- ☐ translation of the earlier application whose priority has been claimed (Rule 66.7(b)).
2. ☐ This report has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rule 64.1). Thus for the purposes of this report, the international filing date indicated above is considered to be the relevant date.

### 3. Additional observations, if necessary:

The subject matter of claim 13 is newly added, not disclosed in the priority document. Therefore, the cited document D4(Plant cell, vol. 16(5), pp. 1206-1219) has been considered to belong to the prior art documents.

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

## 1. Statement

Novelty (N)	Claims	1-13	YES
	Claims	None	NO
Inventive step (IS)	Claims	1, 6-10, 12, 13	YES
	Claims	2-5, 11	NO
Industrial applicability (IA)	Claims	1-13	YES
	Claims	None	NO

## 2. Citations and explanations (Rule 70.7)

(1) The following documents have been considered for the purpose of this report;

D1: NCBI GenBank Accession No. AJ251117 (16 November 2001)

D2: NCBI GenBank Accession No. AF401637 (1 August 2003)

D3: Plant Physiol, Vol. 120(4), pp. 969-978 (1999)

D4: Plant Cell, Vol. 16(5), pp. 1206-1219 (May 2004)

D5: J. Exp. Botany, Vol. 53, pp. 1025-1036 (May 2002)

(2) Novelty and Inventive Step[PCT Article 33(2) and 33(3)]

The present invention relates to a novel use of MADS-box gene having a nucleotide sequence set forth in SEQ. ID. No 1 or SEQ ID NO. 2 containing a region encoding MADS-domain for the regulation of fruit and seed development. It is shown that a transgenic plant which has been transferred with a expression vector comprising said MADS-box gene acquires a phenotype of regulated parthenocarp fruit formation as well as the development of fruit and seed.

D1 and D2 disclose a mads14 gene of SEQ ID No. 1 and mads 16 gene of SEQ ID No. 2, respectively. D3 discloses a MADS-box gene, MsMADS2 and an expression vector, a transgenic plant and the MsMADS2-mediated control of flower development. D4 discloses that MADS domain protein AGAMOUS-like 15 regulates expression of a gene encoding an enzyme involved in gibberellin metabolism. D5 discloses a MdMADS14 gene identical to a gene of SEQ ID No. 1 and a speculative role of said gene in fruit and seed development.

(Continued on Supplemental Sheet.)

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Supplemental Box Relating to Sequence Listing

Continuation of Box No. I, item 2:

1. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this report was established on the basis of:
  - a. type of material
    - ☒ a sequence listing
    - ☐ table(s) related to the sequence listing
  - b. format of material
    - ☒ on paper
    - ☒ in electronic form
  - c. time of filing/furnishing
    - ☒ contained in the international application as filed
    - ☒ filed together with the international application in electronic form
    - ☐ furnished subsequently to this Authority for the purposes of search and/or examination
    - ☐ received by this Authority as an amendment\* on \_\_\_\_\_
2. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed of furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
3. Additional comments:

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**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.  
Continuation of:

Box No. V:

Claims 1, 6-10, 12-13 relate to a newly identified use of MADS-box genes, a transgenic plant whose fruit and seed development is regulated and a composition. Although the specific sequences referred in the above claims are already described in D1 and D2, the use of the genes as a regulator in fruit and seed development was not known or derivable in an obvious manner. Thus, novelty and inventive step can be acknowledged.

However, the subject matter of claims 2-5, 11 directed to an expression vector comprising said genes and a transgenic plant cell transformed with the expression vector according to claim 2 and a method of preparing a transgenic plant is considered to lack an inventive step, since an expression vector or a transgenic plant of a known gene is an obvious technical option for a skilled person in the art.

(3) Industrial Applicability[PCT Article 33(4)]

The subject matter of claims 1-13 is considered to be industrially applicable under PCT Article 33(4).

## 【CLAIMS】

## 【Claim 1】

Use of a MADS-box gene as a regulator in fruit and seed development, wherein said MADS-box gene is selected from the group consisting of a gene having a nucleotide sequence set forth in SEQ. ID. No 1 containing a nucleotide sequence encoding MADS-domain, a gene having a nucleotide sequence set forth in SEQ. ID. No 2 containing a nucleotide sequence encoding MADS-domain and a gene encoding an amino acid sequence having at least 85%

homology within the region other than MADS-domain.

## 【Claim 2】

An expression vector for regulating fruit and seed development in a plant comprising MADS-box gene, wherein said MADS-box gene is selected from the group consisting of a gene having a nucleotide sequence set forth in SEQ. ID. No 1 containing a nucleotide sequence encoding MADS-domain, a gene having a nucleotide sequence set forth in SEQ. ID. No 2 containing a nucleotide sequence encoding MADS-domain and a gene encoding an amino acid sequence having at least 85% homology within the region other than MADS-domain.

## 【Claim 3】

The expression vector according to Claim 2 wherein the expression vector is *pMdMADS14* into which a gene having the nucleotide sequence set forth in SEQ. ID. No 1 is inserted in forward direction (Accession No: KCTC 10588BP).

5      **【Claim 4】**

The expression vector according to Claim 2 wherein the expression vector is *pMdMADS16* into which a gene having the nucleotide sequence set forth in SEQ. ID. No 2 is inserted in forward direction (Accession No: KCTC 10589BP).

10      **【Claim 5】**

A transgenic plant cell transformed with the expression vector according to Claim 2.

15      **【Claim 6】**

A transgenic plant whose fruit and seed development is regulated, and that is prepared by regeneration of the transgenic plant cells according to Claim 5 by tissue culture technique.

20      **【Claim 7】**

The transgenic plant according to Claim 6 wherein the plant is selected from a group consisting of food crops such as rice, wheat, barley, corns, soybean, potato, red bean, oat, sorghum; vegetables such as Chinese cabbage, radish, red pepper, strawberry, tomato, watermelon,

cucumber, cabbage, melon, pumpkin, spring onion, onion,  
carrot; industrial crops such as ginseng, *Acanthopanax*  
*senticosus*, tobacco, cotton, sesame, sugar cane, sugar  
beet, *Perilla japonica*, peanut, rape; fruits such as apple,  
5 pear, orange, jujube, peach, kiwifruit, grapes, tangerine,  
persimmon, plum, apricot, bananas; floricultural crops  
such as rose, gladiolus, gerbera, carnation, chrysanthemum,  
lily, tulip; forage crops such as ryegrass, red clover,  
orchard grass, alfalfa, tall fescue, perennial ryegrass;  
10 fiber crops such as cotton plant; and landscape plants  
such as flowers and shrubs.

【Claim 8】

15 An offspring or a clone of a transgenic plant  
according to Claim 6.

【Claim 9】

A Fruit, seed, ear, tuber, tuberous root, column,  
callus or a protoplast of a transgenic plant according to  
Claim 6.

20 【Claim 10】

The transgenic plant according to Claim 6 wherein  
the plant shows one of the following phenotypes:

a phenotype in which parthenocarpic fruit is formed;  
a phenotype in which seed development is promoted and

ripening is delayed; and a phenotype in which fruit and seed development is inhibited.

【Claim 11】

5 A method of preparing a transgenic plant whose fruit and seed development was regulated, comprising the steps of:

1) Constructing an expression vector comprising the gene according to Claim 1;

10 2) Transferring the vector constructed in Step 1) into Agrobacterium;

3) Co-culturing the transformed Agrobacterium of step 2) with plant tissue; and

4) Regenerating the transformed tissue into a mature transgenic plant.

15 【Claim 12】

A Composition for fruit and seed development in a plant comprising the expression vector according to any one of Claims 2-4 as an effective ingredient.

【Claim 13】

20 A Composition for regulating the synthesis of active gibberellin containing the expression vector according to any one of Claims 2-4 as an effective ingredient.